

Notice of Allowability

Application No.

09/772,457

Examiner

William T. Leader

Applicant(s)

NAKAMURA ET AL.

Art Unit

1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the papers filed 17 December 2003.
2. ☒ The allowed claim(s) is/are 1-6 and 9.
3. ☒ The drawings filed on 30 January 2001 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☒ All b) ☐ Some* c) ☐ None of the:
 1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|---|--|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input checked="" type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date <u>20040129</u> . |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Derek S. Jessen on February 6, 2004.

The application has been amended as follows:

In the Claims:

Claim 1 has been rewritten as follows:

1. A method of plating for filling via holes, in which each of via holes formed in an insulation layer covering a substrate so as to expose, at its bottom, part of a conductor layer located on the substrate, is plated with copper to [be filled with the plated metal] fill the via holes with plated copper, the method comprising the steps of:

forming a copper film on the top surface of the insulation layer covering the substrate, and the side walls and bottoms of the respective via holes,

[providing] forming a strike plating of copper on the surface of the copper film,

immersing the substrate having the copper film and copper strike plating formed thereon in an aqueous solution containing a plating promoter to thereby deposit the plating promoter on the surface of the copper [film] strike plating,

removing the plating promoter from the surface of the copper [film] strike plating located on the top surface of the insulation layer and leaving the plating promoter on the side walls and bottoms of the respective via holes, and

electroplating the substrate having the copper film [formed] and copper strike plating with copper to thereby fill the via holes with the plated copper and simultaneously form a continuous copper film which eventually covers the via holes filled with the plated copper as well as the copper [film] strike plating previously formed on the top surface of the insulation layer.

Claim 6 has been rewritten as follows:

6. The method of claim 1, wherein the plating promoter is removed by a process or treatment selected from the group consisting of (1) an etching process using an etching solution for copper, (2) a cyanide electrolytic treatment using a cyanide electrolytic bath, (3) an ultraviolet radiation treatment obliquely irradiating the surface of the copper [film] strike plating on the insulation layer with ultraviolet radiation, and (4) a treatment of polishing the surface of the copper [film] strike plating on the top of the insulation layer.

Claims 7, 8 and 10 have canceled.

In the Abstract:

The abstract has been rewritten as shown on the attached sheet.

COMMENTS

Claim 1 has been amended to clarify the wording of the claim. In the amendment filed on November 17, 2003, applicant added the limitation of claim 11, "providing a strike plating of copper on the surface of the copper film", to claim 1 before the step of depositing the plating promoter. As explained at page 13, lines 14-27 of the specification, the plating promoter can be evenly and uniformly deposited on the clean surface provided by the copper strike plating. Thus, rather than being formed on the first copper film as previously recited in claim 1, the plating promoter is deposited on the copper strike plating. Claim 1 has been amended to be consistent with the limitation added in the November 17 amendment by indicating that the plating promoter is deposited on the copper strike plating. Claims 7, 8 and 10 have been canceled as being directed to non-elected species. The abstract has been shortened to less than 150 words as required by MPEP 608.01(b).


As noted by applicant at page 5 of the Remarks, the wording of the reasons for allowance of claim 11 as written in the previous office action was incorrect. The correct statement is as follows: the prior art of record does not suggest forming a strike plating of copper on the surface of the initial copper film formed in the process of claim 1 prior to the immersion of the substrate in the plating promoter-containing solution.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William Leader whose telephone number is 571-272-1245. The examiner can normally be reached Mondays through Thursdays from 8:00 to 4:30 and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King, can be reached at telephone number 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


William Leader
February 6, 2004


ROY KING
SUPERVISORY PATENT
TECHNOLOGY OFF

Abstract

A method of plating for filling via holes, in which each via hole is formed in an insulation layer covering a substrate so as to expose, at its bottom, part of a conductor layer located on the substrate. [, is plated with copper, to be filled with the plated metal, the method comprising the steps of forming a] A copper film is formed on the top surface of the insulation layer covering the substrate, and the side walls and bottoms of the respective via holes. [, immersing the substrate having the copper film formed] A strike plating of copper is provided on the copper film, and the substrate is immersed in an aqueous solution containing a plating promoter to thereby deposit the plating promoter on the surface of the copper [film,] strike. [removing the] The plating promoter is removed from [the surface of] the copper [film] strike plating located on the top surface insulation layer [and] while leaving the plating promoter on the side walls and bottoms of the respective via holes. [, and] The substrate is subsequently electroplated with copper to fill the via holes. [electroplating the substrate having the copper film formed with copper to thereby fill the via holes with the plated copper and simultaneously form a continuous copper film which eventually covers the via holes filled with the plated copper as well as the copper film previously formed on the insulation layer. The method is suitable for satisfactorily filling via holes, having a small diameter and a large aspect ratio, with plated copper.]